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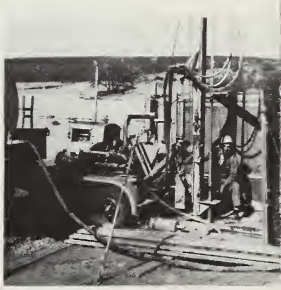
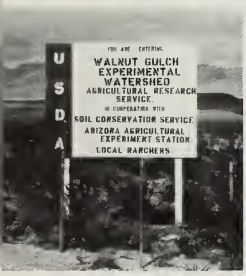
THE SOUTHWEST RANGELAND WATERSHED RESEARCH CENTER
Tucson, Arizona





Science and Education Administration
United States Department of Agriculture

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A land imprinter is being developed as a possible one-step method of range renovation. The imprinter crushes brush, slows and collects surface runoff, reseeds, and increases infiltration, which in turn increases the chances of survival of new grass.

conduct rangeland research begun by the Soil Conservation Service (SCS). The SCS had maintained experimental watersheds, mostly measuring rainfall and runoff, near Safford, Ariz., and Albuquerque, N. Mex., since 1939. More active and diverse rangeland research was begun in 1954 on different watersheds — Walnut Gulch near Tombstone, Ariz., and Alamogordo Creek, near Santa Rosa, N. Mex.

In 1966, several small watersheds near Capitan, N. Mex., were added to the experimental network. In 1975, cooperative studies with the U.S. Forest Service were begun on the Santa Rita Experimental Range near Tucson. Instrumentation was established on several small watersheds to evaluate the effects of herbicides used for brush control for cattle grazing on sedimentation and water resources.

Scientists at the Southwest Rangeland Watershed Research Center are seeking new and improved methods to more effectively and efficiently utilize rangelands while at the same time increasing their long-term productivity. The Center's researchers seek wider knowledge on the use and conservation of rangeland resources. Such knowledge and awareness will play a vital role in the future development, management, and conservation of our rangelands.

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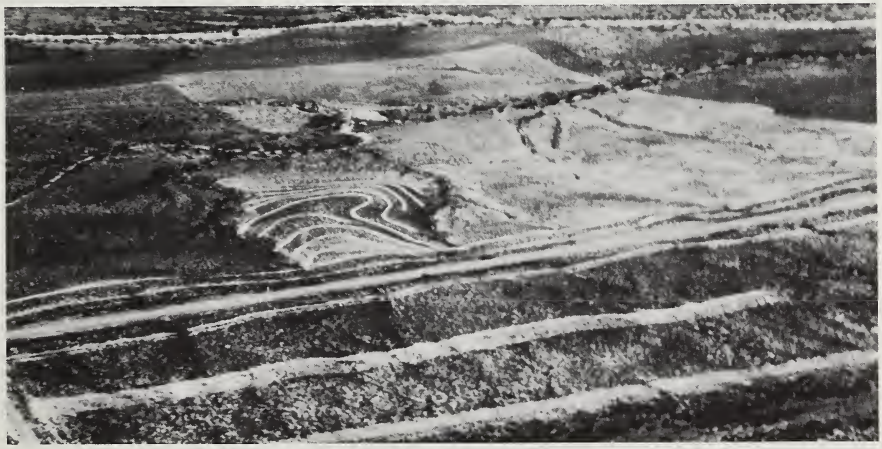
Mission

The mission of the Center is to study the hydrology of rangeland watersheds and the effects of changing land uses and practices on the hydrologic cycle. This includes the rainfall, which is natural input to the watersheds; the quality and movement of water on the surface and below the surface; erosion from the watersheds and channels within the watersheds; sedimentation within the channels and reservoirs; and the present and potential uses of available water. Primary emphasis is on:

- Understanding and evaluating the effects of changing land use, including range renovations and conservation practices, and
- Developing the principles for such understanding in order to apply the results and findings from research areas to areas having little or no research data.

Center scientists use the data from experimental areas in Arizona and New Mexico to study the quality and quantity of water from southwestern rangelands. Information obtained from these rangeland watersheds is used to determine their present and future water resource potentials, which include managing the use of the water for competing local and downstream users; establishing soil, water, and grazing management systems for increasing and stabilizing forage production; providing design concepts and criteria for flash flood and sedimentation control; and monitoring the movement of non-point source polutants on semiarid rangelands. Simulation models are developed and used to transfer data and ideas to ungaged areas.

The research team includes hydrologists, hydraulic engineers, soil scientists, a geologist, a mathematician, and support personnel, including secretaries, clerks, and maintenance personnel.



Range renovation has been practiced on several areas on the Walnut Gulch watershed. The lighter area has been root plowed to kill the brush and give beneficial grasses a better chance to survive and increase.

Current Research

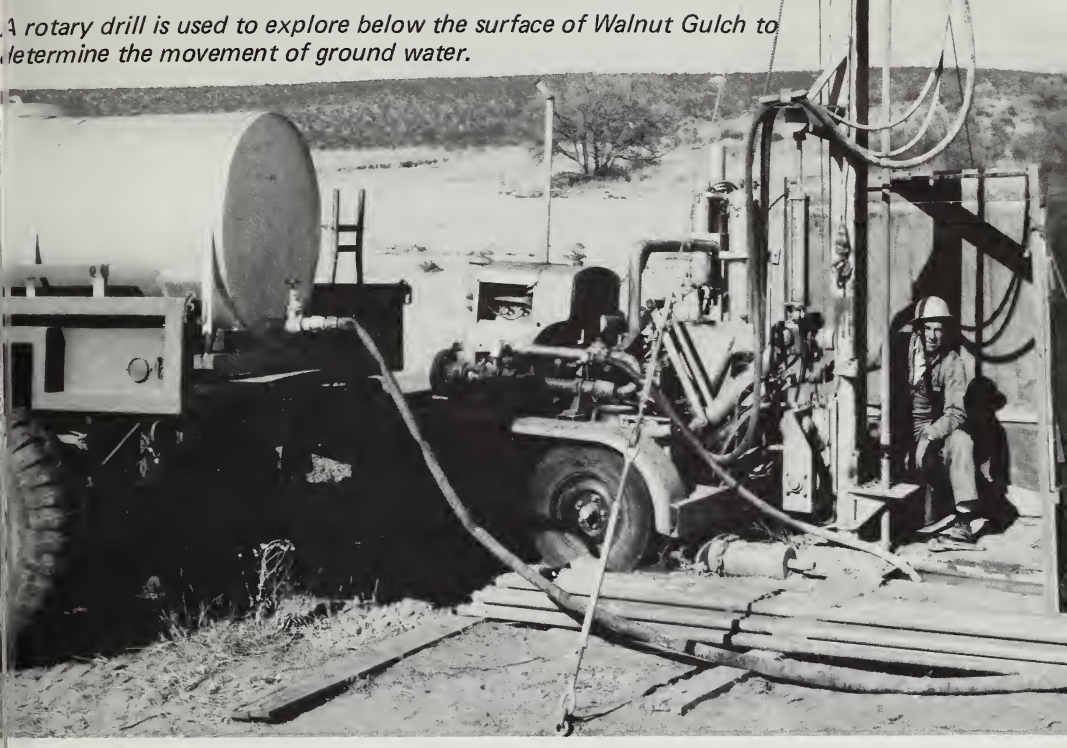
Ongoing research activities are centered on:

- Improving hydrologic forecast and simulation techniques
- Implementing infiltration control to either induce additional infiltration or inhibit infiltration for maximum forage production
- Evaluating the nutritional and moisture requirements of desirable range plant species so that the hydrologic cycle can be managed for maximum forage production while maintaining downstream water supplies
- Developing grass seeding criteria (based on land management practices and knowledge of precipitation probabilities) to improve the chances for success in reseeding depleted rangelands
- Evaluating the effects of vegetation manipulation on the hydrologic balance and erosion/sedimentation of watersheds
- Developing ways to monitor and control the movements of agricultural chemicals (used for forage production improvement) to water sources for ensuring environmental protection
- Providing the basic knowledge and technology needed to prepare environmental impact statements and plans to control nonpoint (distributed) pollution from rangelands

These current programs are all part of a comprehensive plan to maintain agricultural production on rangelands at a cost taxpayers can afford while maintaining environmental goals that ensure both availability and wise use of future rangeland resources.

Rainfall, evaporation, and humidity are measured at this weather station on Walnut Gulch near Tombstone.

A rotary drill is used to explore below the surface of Walnut Gulch to determine the movement of ground water.



Ongoing Research

Over the years, work at the Center has been concentrated on describing the time and area variability of thunderstorms, quantifying the reductions in runoff that occur as water travels over normally dry channels, and developing ways to predict the movement of sediment from the land and stream channels to downstream points. The results of this work have provided government agencies such as SCS, the Bureau of Land Management, and the Forest Service, as well as individual ranchers and land management consultants, with data necessary for designing water storage and water spreading systems, reducing erosion, building diversion dikes, and increasing available plant water.

Extensive studies based on more than 20 years of records from dense recording rain gage networks have shown the extreme variability both in time and space of runoff-producing thunderstorm rainfall in the Southwest. These studies have led to better measures of the water that is available both to range and downstream water users and have suggested ways in which the available water could be used more efficiently. Also, the extreme seasonal rainfall variability over relatively small areas indicates that grazing units should be much smaller than has been the custom in much of the Southwest. Smaller units allow more efficient grazing without degrading the land through overgrazing.

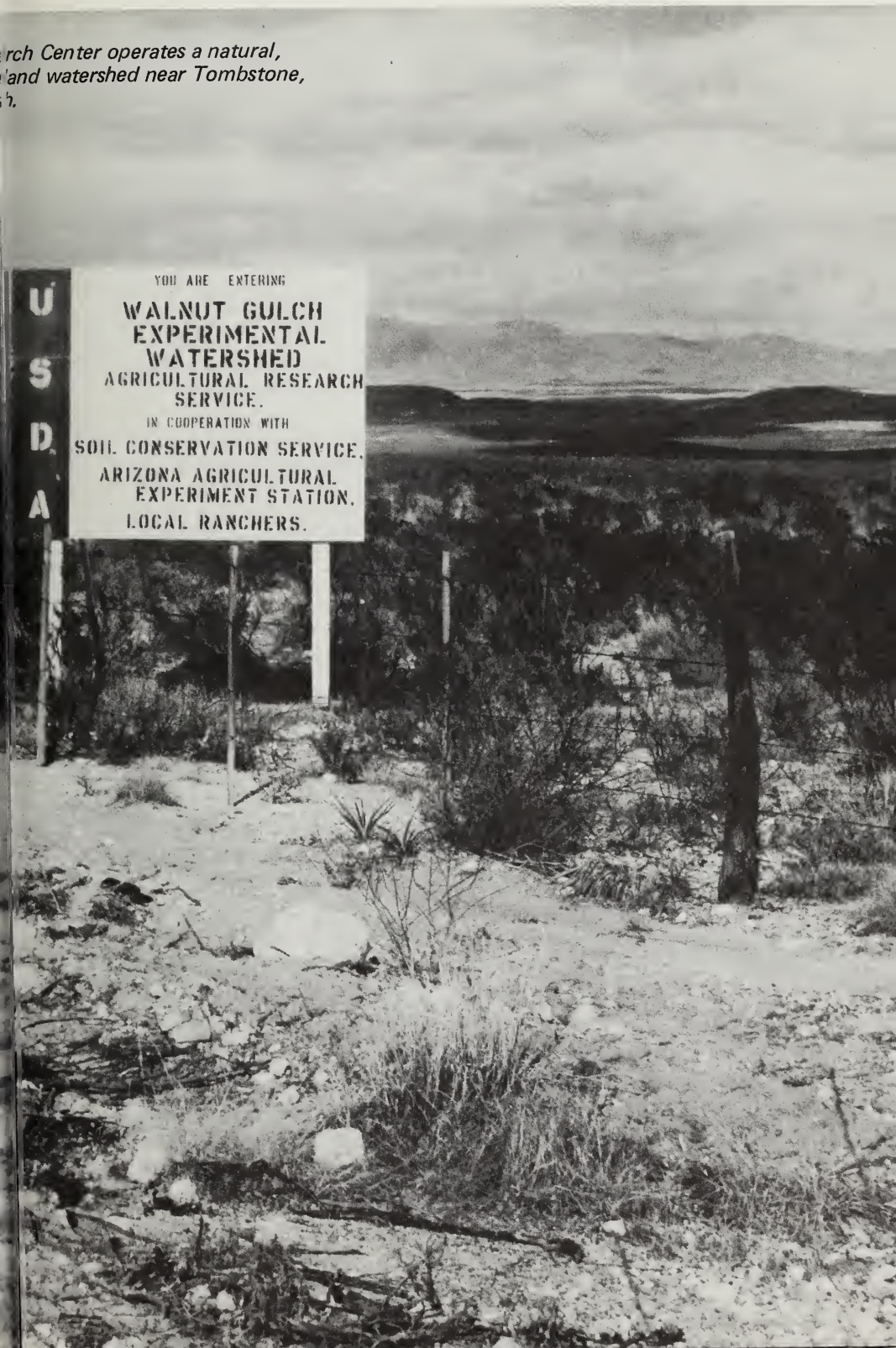
Local studies show that the ephemeral stream channels are very inefficient in conveying water to downstream points. The water losses in the stream channels are called

transmission losses, although actually, some of the water is not lost, and eventually reaches the regional ground water table. However, most of the water is lost to evaporation from the hot streambeds and to transpiration by deep-rooted plants along the channels. The researchers are working on solutions to these situations. In some cases, depending on the geologic features of the area and the needs of the users, it may be desirable to get as much water as possible to a downstream point without loss. For this, ways are being sought to seal the streambeds to make more water available downstream. Conversely, it is sometimes desirable to supplement the ground water table; in which case, the objective is to increase infiltration along particular stretches of the stream channels.

Studies are devoted to developing densely growing vegetation to help reduce soil loss from runoff. Erosion problems are acute in southwestern rangelands where vegetative cover is sparse and the soil is unable to withstand the impact of rain during intense thunderstorms. Low vegetation density and the steep land slopes and channels lead to accelerated erosion of the generally shallow soils. Thus, in many areas, erosion of fine materials from the soil profile leaves the land covered with a gravel surface referred to as "erosion pavement." Such an erosion pavement may then protect the land surface by absorbing the raindrop impact, but it may also reduce infiltration. Erosion often leaves a soil with insufficient depth to support beneficial plants for livestock forage.

The Southwest Rangeland Watershed e
58-square-mile outdoor experimental r
Ariz. Much of the area is covered with

rch Center operates a natural, and watershed near Tombstone, h.

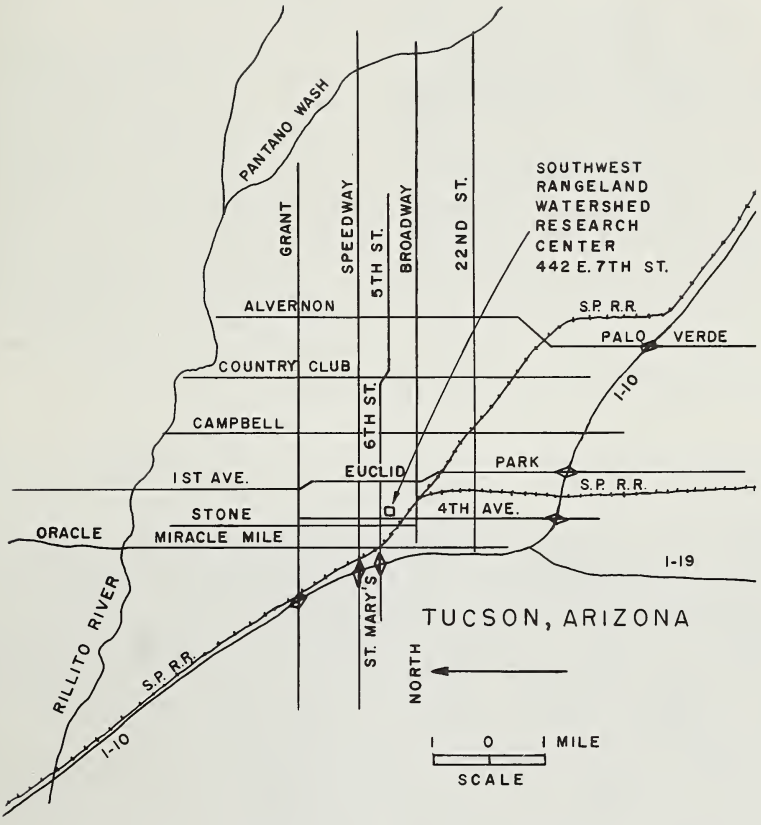


The Future

Ultimately, the objectives of hydrologic research involve developing water resource technology to the point that ranchers would have the knowledge of grazing systems and water supplies needed to manage livestock for maximum utilization of available water while conserving the range resource and minimizing downstream pollution.

These goals include developing grasses that are denser and more drought tolerant to protect the soil from erosive impact of rainstorms and to help increase surface infiltration. The systems will involve water spreading (infiltration control) and will require a broadened knowledge of the water and nutritional needs of plants and of the animals grazing the range. The systems also will require that watersheds be managed to fulfill the downstream water needs by providing artificial recharge to the natural drainage systems and evaporation control to minimize the losses of surface water in streams and reservoirs and in the soil.

Structures (such as this concrete flume) have been built by SEA employees to measure runoff from watersheds from 1 acre to 58-square miles in size.



Visitors and Information

The Southwest Rangeland Watershed Research Center welcomes visitors. Arrangements for tours should be made as far in advance as possible.

To make arrangements for tours, or to obtain information about the Center or SEA research, contact:

Research Leader, SEA-USDA
Southwest Rangeland Watershed Research Center
442 East Seventh Street
Tucson, Ariz. 85705

Telephone: 602/792-6381

Business hours are 8 a.m. to 4:30 p.m., Monday through Friday, except on national holidays.

Questions about SEA research elsewhere in the Western Region, or anywhere throughout the Agency, may be directed by mail or telephone to:

Area Director, SEA-USDA
Arizona-New Mexico Area
2000 East Allen Road
Tucson, Ariz. 85719

Telephone: 602/795-9887

The Science and Education Administration

On January 24, 1978, four USDA agencies — Agricultural Research Service (ARS), Cooperative State Research Service (CSRS), Extension Service (ES), and the National Agricultural Library (NAL) — merged to become a new organization, the Science and Education Administration (SEA), U.S. Department of Agriculture.

SEA is the largest agency of its kind in the world, and the Federal Research (FR) staff is its major research arm. The primary mission of SEA-FR is to help in meeting the food and fiber needs of our nation and of the world.

SEA-FR works in close cooperation with State experiment stations, State departments of agriculture, other government agencies, public

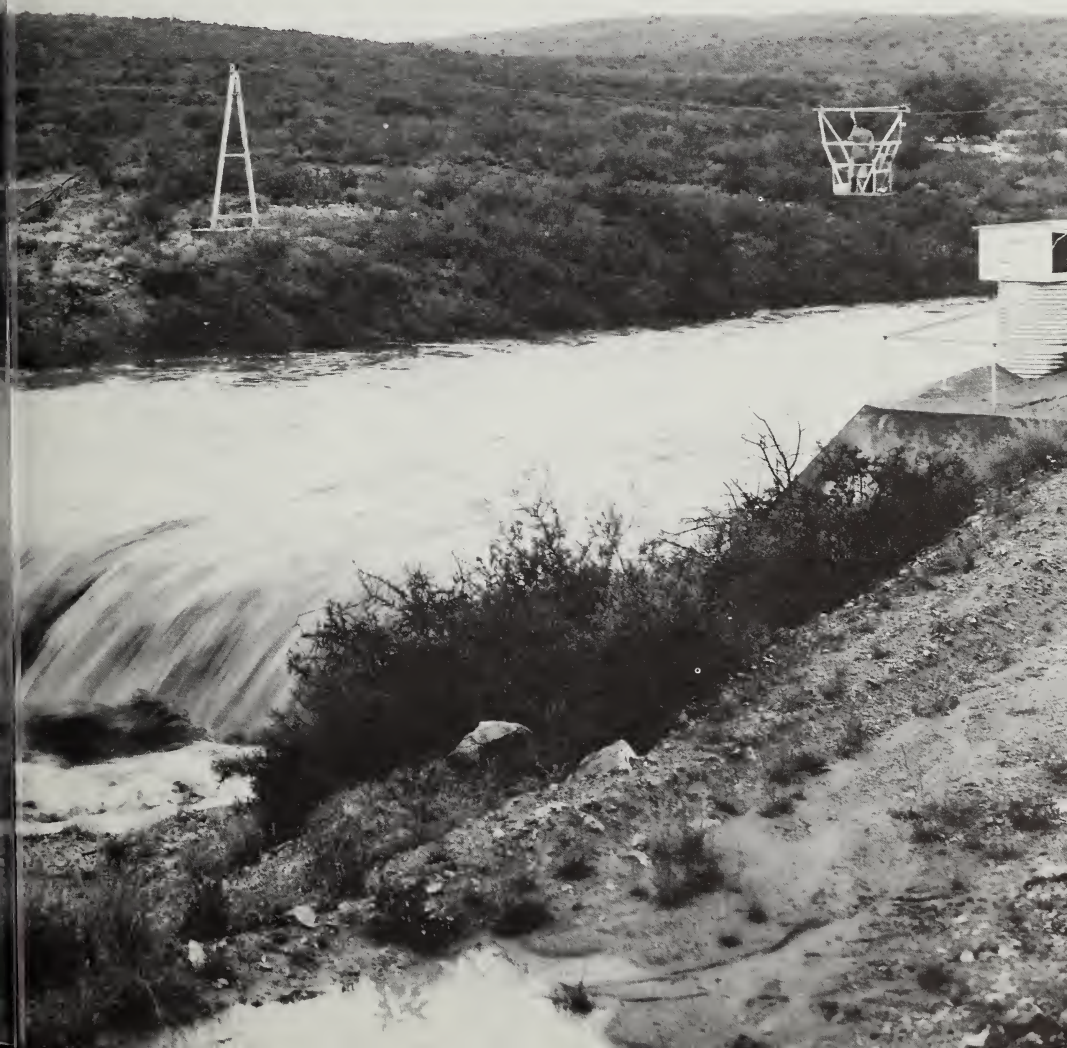
organizations, farmers, ranchers, and industry.

The Agency's research is conducted at more than 150 laboratories, field stations, and work sites in 46 States, the District of Columbia, Puerto Rico, the Virgin Islands, and nine foreign countries. In the United States, SEA-FR facilities are located in four locally administered geographic regions.

Twelve Western States comprise the Western Region, which is headquartered at Berkeley, Calif. Tucson is in the Arizona-New Mexico Area, one of six similar units subdividing the Western Region.

This organization structure is intended to insure both active research programs and maximum responsiveness to the needs and the problems of the people.

A flash flood moves through a measuring station on Walnut Gulch.



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